The Chicken-leg Effect

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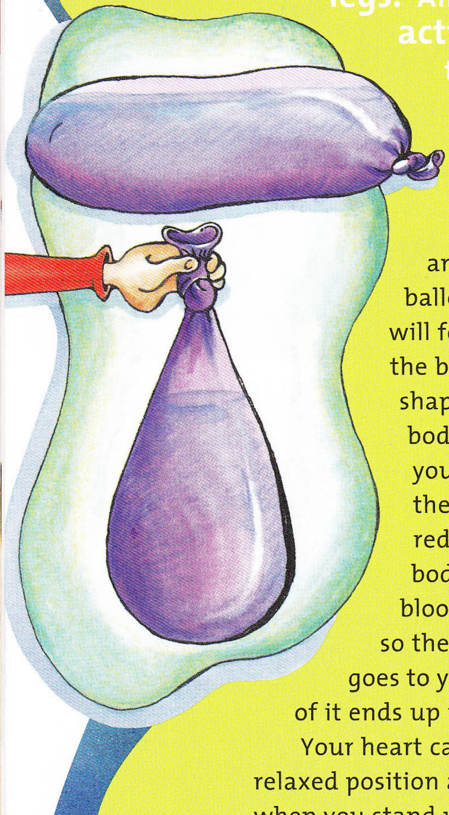
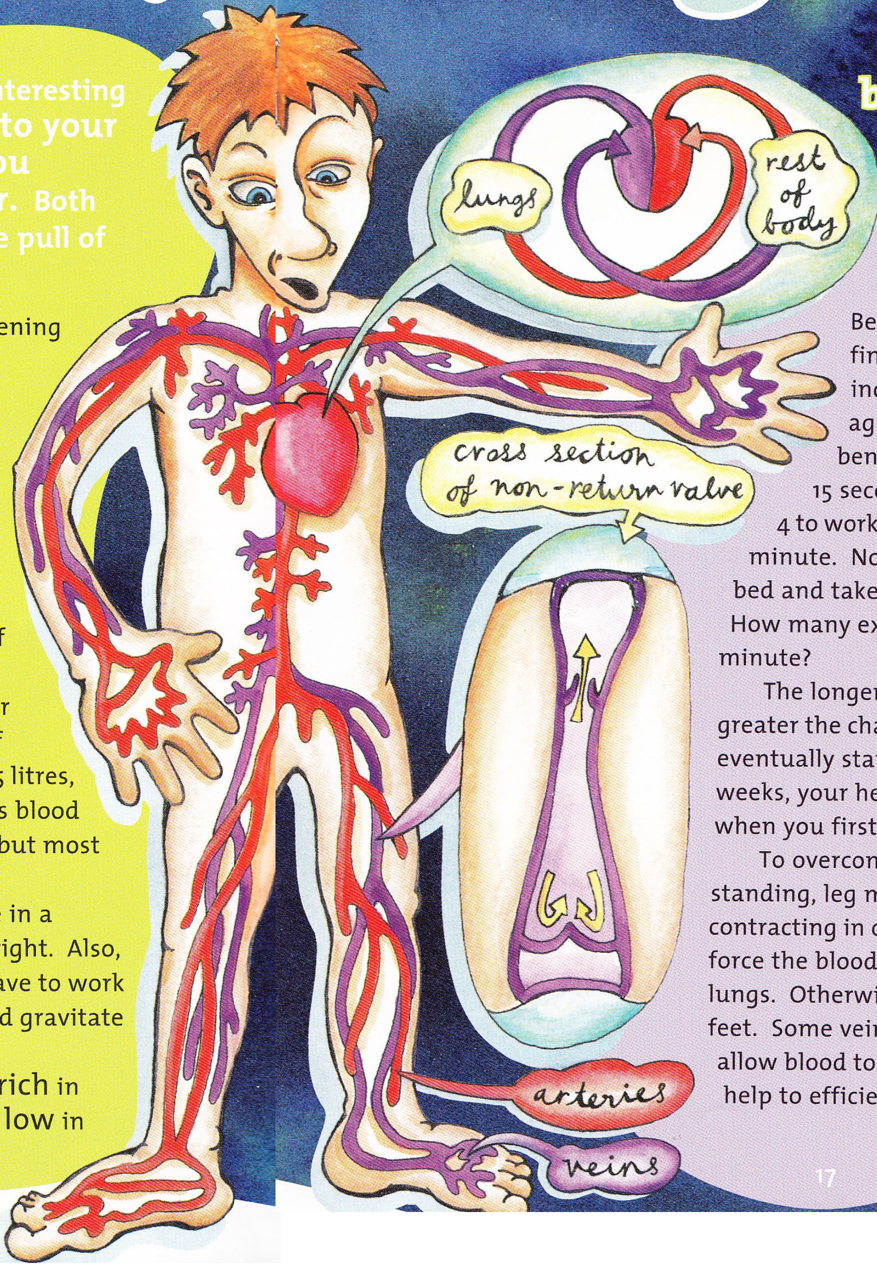
When you jump out of bed after a night's sleep, two interesting things happen. Quite a lot of blood rushes down to your legs. And, even stranger than this, you actually begin to get shorter. Both these effects are caused by the pull of Earth's gravity.



To understand what is happening with your blood, take a sausage-shaped balloon, fill it with water, and lay it on a table. Now pick up the balloon at the knotted end. Gravity will force the water downwards, giving the balloon a bottom-heavy, bulging shape. A similar thing happens to your body when you get out of bed. When you're lying down, about 80 percent of the blood from your legs is redistributed to the upper part of your body. (In adults, this is about 1 litre of blood out of an average body's total of 5 litres, so the change is very great.) Some of this blood goes to your head and a little to your arms, but most of it ends up in your chest.

Your heart can beat more slowly because you're in a relaxed position and don't have to hold yourself upright. Also, when you stand up, your heart and other muscles have to work harder to keep blood circulating. Otherwise, it would gravitate down into your legs and feet.

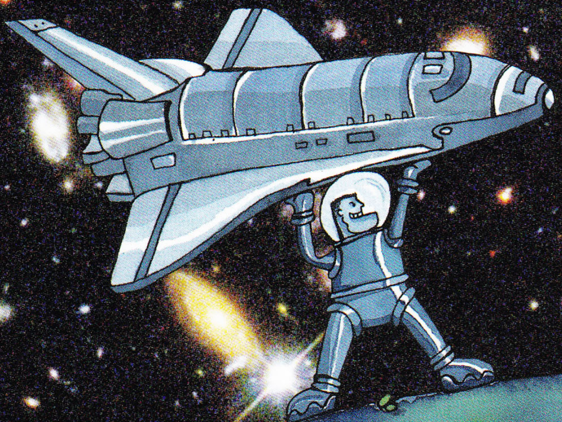
(Note that the blood in your arteries is red and rich in oxygen. The blood in your veins is bluish and low in oxygen.)



Try a simple experiment. Before getting up in the morning, find your pulse by lightly holding the index and middle finger of one hand against your neck, just under the bend in your jaw. Count the beats for 15 seconds and multiply the number by 4 to work out how many beats there are per minute. Note this number. Then get out of bed and take your pulse again while standing. How many extra beats are there in the first minute?

The longer someone stays in bed, the greater the change in their heart rate when they eventually stand up. If you lay in bed for 2 weeks, your heart rate would almost double when you first stood up.

To overcome the force of gravity when standing, leg muscles help the heart by contracting in order to put pressure on veins and force the blood back up towards your heart and lungs. Otherwise, it would pool in your legs and feet. Some veins have non-return valves that allow blood to flow in one direction only. These help to efficiently move blood upwards.

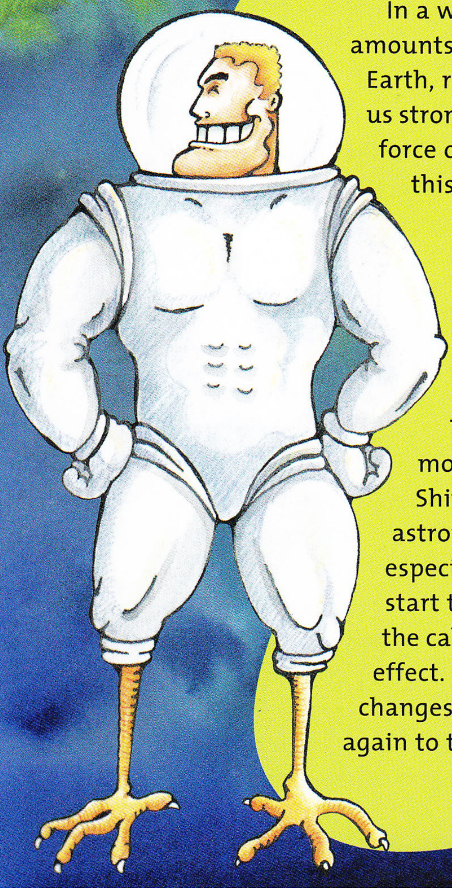


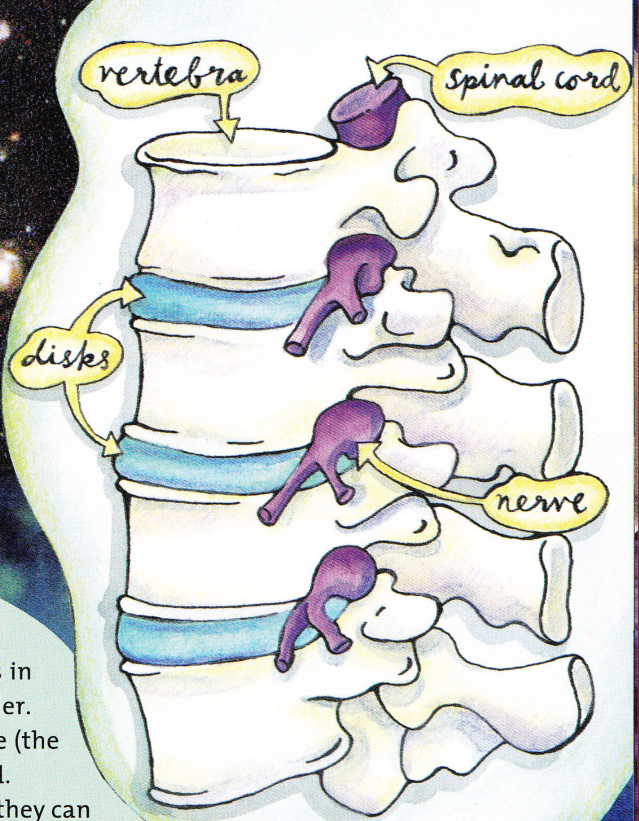
Gravity helps us get stronger. Imagine lifting weights in space.

In a weightless environment, we could lift huge amounts easily, but it wouldn't make us stronger. On Earth, running, jumping, climbing, and lifting make us stronger because most of what we do is against the force of gravity. In space, the seeming absence of this force changes an astronaut's body.

If blood isn't affected by gravity, heart and body muscles don't have to work so hard to pump it upwards. Because of this and a general lack of exercise, muscles begin to waste away.

Also, fluids shift into the upper body. They collect mainly around the waist, but their most noticeable effect is puffiness of the face. Shifting fluids have a dramatic effect on an astronaut's legs too. They become thinner, especially around the calves. Because the thighs start to look much larger than usual compared to the calves, the phenomenon is called the chicken-leg effect. When an astronaut returns to Earth, these changes last only a few weeks until the body adapts again to the effects of gravity.





Another change that occurs in space is that astronauts get taller. The discs between our vertebrae (the bones in our back) contain fluid. Because the discs contain fluid, they can change shape as the day goes on. The change is caused by our own weight squashing the discs into a slightly flatter, wider shape. As a result, we become a bit shorter. Because there is no weight in space, the spinal discs are not under pressure. They become slightly narrower and thicker. Astronauts therefore grow taller, gaining as much as 4 to 6 centimetres of extra height while they're in space.

On Earth, an adult can lose 2 or 3 centimetres in height during the day. Check this out by measuring an adult first thing in the morning and again after they've been up all day. Has gravity made them shrink?

Most of us will never have a chance to go into space and so will always be affected by gravity. But don't worry. Although we might missing out on a fantastic experience, at least we won't have chicken legs!